sub-families of butterflies, to Coleoptera as well as to Lepidoptera.

I cannot conclude without warmly thanking my friend Mr. Marshall for the pleasure I have enjoyed in the work which we have done together.

E. B. P.

2. Experiments on Mantidæ in Natal and Rhodesia. (G. A. K. M.) *Natal, February* 1897.

I. Gave a wingless *Acræa horta* to a Mantis. It seized it and threw it away. On a second presentation it felt the butterfly carefully with its antennæ, then took it and began eating first the haustellum, then the palpi, and finally the whole head with apparent relish. On biting at the thorax, however, it threw it down with evident disgust and began wiping its mouth on its fore-legs as though to take away the taste. I again presented the butterfly, but the Mantis at first only ran away from it. At last it took it again and began eating the thorax, but quickly threw it down and would have nothing more to do with it.

II. Experiment *a*.—Caught a full-grown Mantis and put it in a large green gauze bag. In the afternoon put in a house-fly, which was not eaten that day, but was gone next morning. Then put in a wingless male *A. horta* (a bitter yellow juice exuded from the wing stumps). On perceiving it the Mantis ran towards it, seized it and made a bite at the back of the thorax, but started back as if in great surprise, and wiped his mouth on his front legs. He exhibited both fear and curiosity; for as the *Acræa* approached he edged away, just keeping far enough off to be able to touch it with the end of his long antennæ, and when the *Acræa* walked away he followed, still feeling it over. At this point I was called away, and on my return found that the *Acræa* had been eaten all except the head and apical half of the abdomen. Afterwards put into the bag the *Amauris echeria* which had been rejected by spider C (Experiment 13), and which was half dead. As the Mantis took no notice of it I left, but on inspection in the evening I found that this butterfly had been entirely devoured, only a few small fragments of wings and legs being left.

Experiment *b*.—Gave the Mantis a perfect male *A.*

horta. He tackled it at once, seizing it from above and biting the thorax, but he quickly let go and began wiping his mouth as before. A few minutes later he made a second attempt with the same result. After this he appeared to avoid it. I then put in a wingless *Amauris echeria* and left him for some time. On my return I found it had been entirely eaten, whereas the *A. horta* was still untouched. Took the *horta* out, cut off its wings and replaced it. The Mantis eyed it with suspicion whenever it came near him, and felt it cautiously with his antennæ; when it came too near him, he backed away and would not attempt to touch it. Later on I tapped the gauze so that the *horta* fell close by the Mantis. He gripped it at once, and began eating away at the underside of the abdomen, but soon threw it down again, and would not touch it although I gave him no other food for twenty-four hours. After that I put in a male *Belenois severina*, which he devoured readily.

Experiment *c*.—After starving the Mantis for twenty-four hours I gave him a *L. chrysippus*. On seeing it fluttering he came down to it eagerly and soon caught it. The large wings prevented him for some time from getting at the body, and he therefore ate away almost half a hind-wing. He then went on and ate the whole insect except the limbs.

Experiment *d*.—Gave the Mantis a *Papilio demodocus*. He had some difficulty in catching it at first, owing to its size and strength, but eventually seized it from below and devoured it.

Experiment *e*.—Gave an entire female *horta* to my captive Mantis. He caught it, bit the thorax and started back with disgust, just as in the previous experiment, but his efforts to get rid of the nasty taste were more prolonged. For over five minutes he continued cleaning his mouth on his fore-legs or rubbing it from side to side on the gauze. I then put in an entire *Amauris echeria*, but he seemed too scared to attempt to touch it. However, he caught it during the night (while there was a light in the room) and ate all the abdomen, leaving the head and thorax.

Experiments on *Mantidæ* at Malvern, Natal.

III. On March 11, 1897, I captured a large female green Mantis [probably *Polyspilota caffra* (Westw.) or very

near it]. On the 12th I gave her an *A. petræa*, which she devoured entirely. On the 13th I gave her an *A. serena;* she seized it and ate a good piece out of one of the hind-wings. She then attacked the thorax, but after a few bites threw down the insect and began ejecting a brownish liquid from her mouth on to a leaf, and also wiped her mouth with her legs in the usual manner. A few moments after I put in a male *Hypolimnas misippus*, which she soon caught and ate. Later on I put in another *A. serena*, but she paid no attention to it. I then put in a *P. demodocus*, with the same result, so I removed them both. On the 14th I gave her no food. On the 15th I put in one *A. encedon* and one female *H. misippus*, but no attention was paid to either. I eventually removed *encedon*, leaving *misippus*. Later on put in *Eurytela hiarbas*, and left both in all night and through the next day, but the Mantis would not touch them. As it was beginning to show signs of weakness I released it.

IV. Experiment *a*.—March 25. Caught another female Mantis [probably the same species as the last], and gave her an *A. cabira*, which she quickly caught. She began by eating part of the fore-wing, but as she reached the base of the costa dropped it suddenly. A little later, while I was not watching, she took it up again and ate all the body except the head and anal segment. I then gave her a *Charaxes varanes* and a *P. demodocus*, which were both eaten immediately in succession.

Experiment *b*.—March 26. Gave the Mantis an *A. cabira*. The day being cloudy and cool, she was sluggish, and it was some time before the butterfly was caught. She missed the first two strokes, catching it at the third and eating it entirely.

Experiment *c*.—March 27. Gave one *A. encedon* to Mantis. It immediately flew right on to her, which seemed to frighten her considerably, and she did not attempt to catch it, but edged away when it approached. This continued for a quarter of an hour, so I took the *encedon* out and put in a *P. demodocus*, which was soon caught and eaten. Later on I put in a *Neptis agatha;* the Mantis seemed rather suspicious of it, but eventually caught and ate it. I then gave her a *Pentila tropicalis*, which she ate, including the whole of the two fore-wings. I then tried her again with the same specimen I had given her in the morning; she caught and ate it without

any signs of distaste. Subsequently gave her *Mylothris agathina*, which was also eaten.

Experiment *d*.—March 28. I gave a male *A. serena* to Mantis. After a few moments she caught it and ate a bit out of the wings, but soon threw it down. The butterfly at once walked straight back to her and was promptly caught again, and after a single bite was again rejected. On looking a few hours afterwards I found it had been eaten. I then gave her a *P. tropicalis* and an *Alæna amazoula*, both of which were eaten, the latter wings and all.

Experiment *e*.—March 29. I gave Mantis one *Eurytela hiarbas*, one *Pyrameis cardui*, one *Junonia clelia*. All were eaten.

Experiment *f*.—March 30. I put one male *A. serena*, one *P. demodocus*, one *N. agatha*, and one *P. tropicalis* into the Mantis' cage at the same time. They were caught and eaten in the order mentioned without any sign of distaste. Immediately after she had finished I put in a brilliant dark-blue moth with orange markings (*Eggybolis vaillantina*), which has a strong smell. To my surprise she completely demolished it, and then ate a second *P. demodocus*.

Experiment *g*.—March 31. Gave Mantis a *P. demodocus* in the morning, which she ate: in the afternoon gave her one *L. chrysippus*, which she ate without any ado, and immediately afterwards a female *H. misippus*. I then gave her an *Acræa natalica*, which she quickly seized, but on biting the thorax dropped it at once. For some time she paid no attention to it, but later on tried it again, biting a little out of the wings and then dropping it again; after which she had nothing more to do with it. Subsequently put in a *Papilio brasidas*, which was promptly eaten.

Experiment *h*.—April 1. In the morning gave Mantis an *A. serena*. She caught it, and after eating the apex of one fore-wing threw it down, but a few seconds after she caught it again, nibbled a bit out of the costa of fore-wing and again threw it down. After a short interval the butterfly walked past her, she seized it, bit at the thorax and at once rejected it. A few moments later she made a fourth attempt, this time eating half an antenna, but again found the taste too much for her. I then removed the butterfly and put in an *A. encedon*, but after nibbling a

small bit out of the wing she would have nothing more to do with it. In the afternoon I tried her with an *A. cabira*, which she also refused; I removed it and put in one *J. clelia* and one *P. brasidas*, but apparently the continued disappointments she had undergone disheartened her, for she would have nothing to do with either of them, but avoided them, and only tried to escape through the glass of the cage. About an hour after she ate the *brasidas*, but had not touched the *clelia* by sundown.

Experiment *i.*—For three days I fed the Mantis only on clearly edible species. On April 5, after eating two *P. demodocus* I gave her *L. chrysippus*, which she soon caught, but after eating a small portion of a hind-wing, she threw it down. A few seconds after, however, she caught and consumed all except the wings. She then ate a male *H. misippus*, and immediately after I put in a male and female *A. cabira*. The male was eaten at once; she then caught the female and ate a piece of the wing, but threw it down after the first bite at the thorax. The butterfly remained for a long time at the bottom of the box feigning death, so I put in another *L. chrysippus*. The movements of the latter disturbed the *cabira*, which was promptly seized by the Mantis, the abdomen being eaten but the thorax rejected. Shortly afterwards the *chrysippus* was caught and eaten from head to tail. Next morning as a sequel to this feast I found the Mantis in an apparently half-dead condition. The abdomen was much distended and no fæces had been passed for twenty-four hours. I therefore gave it no food whatever for two days. On the third day it seemed better and fæces were passed freely, but it still seemed very weak and refused food. Next day I found that it had lost all power of gripping with its fore-legs, so I fed it by hand on edible species. This I continued to do for several days, but it never properly recovered its strength, so I killed it.

V. Experiments on *Pseudocreobotra wahlbergi*, Stål.

1897.

Sept. 3. Lower Umkomaas River. Captured a male *P. wahlbergi*, and gave him an *Acræa cabira;* he nibbled a bit out of the wings, then ate the whole abdomen, but on

reaching the thorax rejected it, the butterfly having still sufficient vitality to flutter about.

Sept. 4. In the morning gave him an *M. safitza*, which he ate at once. In the afternoon put in an *Acræa encedon*, which he seized twice, but on eating a bit of the wing rejected; however, towards evening it was eaten.

„ 5. Gave him an *Acræa serena;* he seemed frightened at first and avoided it, but ate it about an hour afterwards. Put in another later, which remained untouched.

„ 6. The *serena* of yesterday was left uneaten all the morning. I therefore removed it and put in an *A. cabira*, which was also refused.

„ 7. In the morning removed the *cabira*, and put in another *serena*. As the *Pseudocreobotra* had not eaten it towards evening, I gave him an *M. safitza* in addition. He seemed to detect the difference, watching it immediately it was put in, and as soon as it came within striking distance, he seized and ate it, but still paid no attention to the *serena*.

„ 8. The *serena* remained uneaten all day, though from its appearance it had evidently been seized. In the afternoon put in a *Neptis agatha*. The Mantis avoided it at first just like the *Acræa*, but about an hour later I found it had been eaten.

„ 9–11. Wet days and no *Acræas* procurable.

„ 12. Gave Mantis an *M. safitza* and an *A. serena* at the same time; he seemed very frightened of both, avoiding them, or else striking at them in order to drive them away. Some hours later I found the *safitza* had been eaten entirely and a small piece out of the abdomen of the *Acræa*, which, however, was still quite lively.

„ 13. Gave Mantis two *A. serena* during the day, both of which were seized at once and eaten entirely from head to tail without any sign of distaste.

Sept. 15. Put in an *A. serena*. It was eaten after a short interval. Later gave him an *A. encedon*. At first he seemed only frightened, but subsequently caught it, and after taking a bite at the thorax threw it down and paid no further attention to it.

„ 16. Brought *Pseudocreobotra* from Umkomaas to Malvern.

„ 18. Put a *Teracolus omphale* and an *A. encedon* into his box, but they were not touched all day, owing to their inactivity and the large size of the box. The Mantis was also more sluggish in its movements than in a natural state.

„ 19. Caught the *encedon* and offered it to Mantis in my fingers. He objected strongly at first, but eventually took a small nibble but would not try another bite. Offered him the *omphale* in the same way, but being suspicious he refused it also, but at last took a bite, and, finding it all right, ate it all. On again putting the *encedon* near his mouth he only felt it with his palpi but would not eat.

„ 20. Left the same *encedon* in all day in hopes that he might be compelled to eat it by hunger; but he did not do so.

„ 21. *Encedon* untouched, so removed it and put *Pseudocreobotra* into a smaller box with the specimens of *A. serena*, but he seemed to take no interest in them. On holding one of the butterflies to his mouth, he felt it persistently with his palpi and seemed almost as though he were trying to eat but could not. He was certainly weaker on his legs.

„ 22. One of the *encedon* died during the night, and in the course of the morning I found the Mantis apparently eating at its head as it lay at the bottom of the box, without using his fore-legs, which were held out on each side. However, on taking up the butterfly I found he had made no impression on it. I then placed a *Terias brigitta*

close to his mouth, and he mumbled at it in the same manner without eating. It therefore seemed evident that his mandibles must have been paralyzed in some way, and on examination this proved to be the case, for they could be moved easily with a pin backwards and forwards, the insect clearly having no control over them whatever. The grip of the forelegs though noticeably weaker than normal was not completely lost, as in the previous experiment with a "Charaxes-eating" Mantis. I am inclined to think that the insect became at last partially blind, both from its actions and from the appearance of a small discoloured patch in the left eye, a symptom which also occurred in the "Charaxes-eating" Mantis.

The results of Experiment VI. practically negative the supposition that any of the above symptoms might be due to *insufficient* food.

VI. Experiments on Leaf Mantis (*Phyllocrania insignis*, Westwood).

[One of Mr. Marshall's specimens was compared with the type of the above-named species in the Hope Collection.]

At the Lower Umkomaas River, during September, I kept two specimens of this insect for twelve and fourteen days respectively without a particle of food, and neither their vitality nor activity were in any way impaired at the end of that period. When captured they were in their pupal instar, and the final change took place on the 10th and 7th days respectively, both insects casting their skins in a normal and healthy manner in spite of their long fast.

VII. Experiments on "Charaxes-eating" Mantis (*Polyspilota caffra*, Westwood, or very near this species).

1897.

Sept. 23. Caught, at Malvern, Natal, a "Charaxes-eating" Mantis (in the pupal stage), and gave him a *T. achine* and an *Acræa*

serena at the same time. He was somewhat wild at first, paying no attention to them but only trying to escape. Eventually he took the *achine* from my fingers and ate it, and later caught and ate the *Acræa*.

Sept. 24. Mantis ate a *Belenois severina*.

„ 25. Mantis ate two *Acræa encedon* without showing any signs of distaste.

„ 26. Gave him two *A. encedon*, but they were not eaten.

„ 27. Mantis ate one *encedon*.

„ 28. The second *encedon* dead. Put in four *Pardopsis punctatissima*, but no notice was taken of them.

„ 29. Mantis still refused to eat. Two *P. punctatissima* dead. Put in one *A. encedon*.

„ 30. One more *P. punctatissima* dead, and the remaining one was three-parts eaten, the *encedon* being left.

Oct. 1. Gave Mantis one *P. punctatissima* and one *A. serena* in addition, but he made no attempt to catch any of them, even when they settled quite close, merely feeling towards them with his antennæ; if they came too near he only ran away or else drove them off by striking out straight with his fore-legs. The discoloured patch in the left eye made its appearance on this day, and the sight on that side was evidently somewhat impaired. The legs also seemed to be weakening, and the grip of the front pair was not so strong as in normal specimens.

„ 2. No butterflies eaten, though I tried several times. I think that he may have been preparing for the final change of skin, which would account for his refusal to eat.

„ 3. Mantis attempted to perform the final ecdysis during the night, but owing to his bad state of health could not free himself properly from the old skin, being permanently deformed in a doubled-up

attitude when I first looked at him. I therefore killed him.

Judging from Experiment VI. the inability to change can hardly be attributed to weakness caused by want of food.

[In relation to the above-recorded experiments it is important to know the habits and natural food of the Mantis, and if possible to determine the species. Mr. Marshall kindly sent a specimen of an identical, or at any rate very closely-allied species, together with the following notes. —E. B. P.]

"*Umkomaas Mouth, Natal; Sept.* 3, 1897.—The Malvern species of Mantis is one of the largest out here, and I selected it as I knew it to be almost entirely a butterfly feeder. It frequents chiefly Acacias and their allies, and catches the *Charaxes* which come to suck the gum. Unfortunately they are scarce at Malvern, and I could not procure a single specimen during the winter, for I had hoped to make the very experiment you suggest, viz. feeding exclusively on Acræas or *L. chrysippus*. However, I caught two small Mantises on my arrival here (Umkomaas Mouth) yesterday, but I have not as yet even seen an *Acræa*."

"*Malvern, Oct.* 7, 1897.—I am not quite certain whether the Charaxes-eating Mantis sent is specifically identical with the one that died from *Acræa* diet. I thought it was the same in the pupal stage, but the imago of the latter has the upper wings entirely green, with a small yellowish spot about the middle. Unfortunately I have not been able to get one."

[The Mantis sent (captured at Malvern, Sept. 1897) was *Polyspilota caffra* (Westwood), of which the type is in the Hope Collection, Oxford.—E. B. P.]

VIII. Experiments with *Pseudocreobotra wahlbergi*, Stål, female.

1897.

Sept. 26. I captured at Malvern a full-grown female Ocellated Mantis, which ate a specimen of *Acræa encedon* during the day.

„ 27. Gave Mantis two *A. encedon*. She ate the thorax of one, rejecting the remainder.

„ 28. The remaining *encedon* died to-day. Removed it, and put in one *Acræa neobule*

and five *Pardopsis punctatissima*, but the Mantis would not touch any of them.

Sept. 29. Mantis still refused to eat, one *P. punctatissima* dead.

„ 30. Three more *punctatissima* dead. Mantis ate the *neobule* entirely.

Oct. 1. The remaining *punctatissima* dead. Put in two *Acræa encedon* and one *A. serena*. The Mantis seemed more keenly alive to their presence than usual, eagerly following them in their flight with sharp turns of the head like a cat watching a swallow. At last the *serena* gave her a chance, and was immediately seized and eaten. No more were eaten during the day, and towards evening I put in another *A. serena*.

„ 2. The day being dull the three butterflies were quite inactive. I therefore placed the *serena* near the Mantis, which soon seized it, and ate nearly the whole of one fore-wing and part of the other; finding this unsatisfactory she dropped it. I then offered her an *encedon*, which was promptly taken and devoured entire, and immediately afterwards the *serena* was eaten.

„ 3. Wet day: no Acræas procurable. Remaining *encedon* dead.

„ 4. Gave Mantis two *A. encedon*. She was evidently hungry, on two occasions making futile jumps towards the butterflies as they fluttered past, instead of waiting for them to come within striking distance; there was however a noticeable decrease in her general vivacity. Eventually she caught both butterflies in quick succession, and devoured them completely. After the head of the second one was eaten, a large drop of yellow liquid oozed from the thorax. On tasting it she drew back quickly and seemed uncertain whether to go on or not, but finally put her mouth to it and sucked it all up,

though it appeared to me as if it were done under protest.

Oct. 5–6. No Acræas procurable.

„ 7. Put four *P. punctatissima* into her box at the same time. During the short time I was watching I saw her catch one or other of them no less than *seven* times, but on each occasion after the first nibble or two she threw it down with evident disgust.

„ 8. I was absent all day, but all the butterflies had evidently been further attacked by the Mantis, and small pieces had been eaten out of the fore-wings, but in no case had the bodies been damaged.

„ 9. Removed all the *punctatissima* and put in two *A. cabira* and one *A. cnecdon*, which were consumed entirely in quick succession. The Mantis appeared to show no decided symptoms of ill-health at present. I was unable to complete the experiment.

IX. First Experiment with Mantis. Salisbury.

1898.

March 2. Caught a pair of large green Mantis *in copulâ* [*Sphodromantis lineola*, Burm.].

„ 3. Gave them one *A. caldarena*, one *A. halali*, and one *A. neobule*, but they were all untouched.

„ 4. The *caldarena* had been caught and discarded, the thorax and one wing being partly eaten; removed the butterflies.

„ 5. Female Mantis ate the male. Put in two *caldarena* and one *induna;* Mantis tasted one of the former but quickly threw it down. During the day the other two were evidently caught and tasted, as they were both more or less damaged about the head and thorax.

„ 6. Mantis ate one *caldarena* and the *induna;* remaining *caldarena* died from injuries.

„ 7. Put in three *caldarena*, one of which was partially eaten.

March 8. One other *caldarena* completely eaten; the third died, its head having been partly eaten.

„ 9. Put in one female *haladi* and one male, and one female *caldarena*. The former was soon caught, but after a few bites was rejected with evident disgust.

„ 10. Male *caldarena* eaten completely, female partially.

„ 12. Put in male *natalica*, one male and one female *caldarena;* the two former partially eaten. The latter was caught three times in quick succession, but promptly rejected on each occasion after the first bite.

„ 13. Put in a male *haladi*, which the Mantis took at once, throwing it away after eating about half the thorax. Then gave her a male *caldarena*, which was completely eaten, so put in a second, which she promptly caught, but threw it down after the first bite at the thorax. She caught it again about a minute afterwards and started eating the apex of abdomen, but two bites were sufficient. A third attempt ended similarly.

„ 14. Saw Mantis seize and reject the same *caldarena* twice; removed it in the evening.

„ 16. Put in a male *caldarena*, which was completely eaten, but a second which I gave her immedately afterwards remained untouched. The Mantis began to show distinct signs of weakness, and I observed an opaque blackish spot in her left eye to-day for the first time.

„ 17. The male *caldarena* was killed to-day by a bite on the head. Mantis began to nibble off the end of one of her front tarsi, a sign that her end is not far off.

„ 18. Gave her a female *caldarena*, which was caught several times but not eaten. She continued to nibble at her tarsi.

„ 19. Mantis oviposited during the night, but the egg cocoon was only half as large as usual in this species [eggs proved to be infertile].

Gave her one male *halali* and two male *caldarena*. They were all caught in succession, but she only ate a very small piece out of each. At times she seemed very frightened of them, and in running away she twice fell upon her back, when she had some difficulty in righting herself owing to weakness.

March 20. Put in three male *caldarena*, one of which was caught and the whole of one forewing and part of the thorax eaten.

„ 21. Remaining two butterflies untouched. Mantis had by now eaten off the ends of all her tarsi except the anterior and intermediate on one side.

„ 22. In the afternoon I found the Mantis dead on her back.

X. Second Experiment with Mantis. Salisbury. 1898.

March 19. Caught a large green female Mantis of same species as previous one [*Sphodromantis lineola*, Burm.], and gave her one *Junonia cebrene* and three *Terias senegalensis*, all of which she ate. She also ate the following:—

„ 20. One *T. senegalensis*, one *T. brigitta*, one *Belenois severina*.

„ 21. One *J. cebrene*, one *Catochrysops osiris*.

„ 22. Two *Alæna amazoula*, without showing any signs of distaste.

„ 23. One *Spindasis natalensis*, two *J. cebrene*.

„ 24. One *T. senegalensis*, two *Myrina ficedula*.

„ 25. The Mantis escaped from the box this morning, and I did not find her till 5.30 p.m., when she was busy ovipositing on the side of a book. She had then laid about a third of her eggs, and did not stop laying till 8.30 p.m.

„ 26. Mantis ate one *Parosmodes ictaria*, and two *Hesperia spio*. She seemed very hungry, following the butterflies about instead of waiting for them to come within striking distance.

March 27. She ate one *Catopsilia florella;* I then put in a *Belenois mesentina,* and she became much excited, running about after it, and making several futile snatches at it on the wing. At last she gave a vigorous stroke, and missing the butterfly caught the gauze with which the box was covered. Imagining apparently that she had caught her prey, she began trying to eat the gauze, in spite of my attempts to drive her away, for fully two or three minutes. At last she desisted and soon caught and devoured the butterfly, eating a *B. severina* and *Axiocerces harpax* immediately afterwards.

„ 28. One *Precis sesamus* and one *B. mesentina.*

„ 29. One *Hamanumida daedalus* and one *B. severina.*

„ 30. One *Pyrameis cardui* and one *B. mesentina.*

„ 31. One *J. cebrene* and two *B. severina.*

April 1. One *J. cebrene* and one *C. florella.*

„ 2. Two *C. florella* and one *P. cardui.*

„ 3. Mantis escaped. She was fully as vigorous and healthy on the last day as when first caught.

XI. Third Experiment with Mantis. Salisbury.

1898.

April 3. Captured a female Mantis closely allied to those of preceding experiments, being of same size and colouring, but having a much broader thorax and the mouth pink. This insect I submitted to a purely distasteful diet, combined with periods of starvation, as follows:—

„ 4. Three *Acræa caldarena* eaten.

„ 6. Two „ „ „

„ 7. Two „ *axina* „

„ 8. One „ *caldarena* „

„ 9. Two *Limnas chrysippus* „

„ 10. One „ „ „

„ 11. One „ „ „

„ 12. One „ „ „

April 16. One *Limnas chrysippus* eaten.
„ 20. One „ „ „ ; then left her a month entirely without food, which however did not seem to affect the health or vitality in any way.
May 19. One *Acræa axina* eaten.
„ 22. One *L. chrysippus* „
June 4. One „ „ „
„ 5. Two „ „ „ This insect never once exhibited the least signs of distaste for any of the butterflies, and devoured them all with avidity, showing a marked contrast to the Mantis first experimented with (IX.), which throughout exhibited an intense dislike to the Acræas, and evidently ate them from sheer hunger.

The close proximity of these two kinds of Mantis suggests the idea that they might possibly be seasonal forms of one species in which the winter form has adapted itself to an *Acræa* diet, owing to the comparative scarcity of other butterflies at that season. In spite of its diet and long fast, this Mantis was still fully as vigorous and healthy as when first captured.

„ 30. Ate one *L. chrysippus*.
July 8. Gave it two *Acræa axina;* it tasted both of them several times, but in every case at once discarded them with evident disgust.
„ 22. Gave it two more *A. axina* with precisely the same result.
Aug. 21. Ate one *L. chrysippus*.
„ 22. „ „ „ „
„ 28. „ „ „ „
„ 29. „ two „ „
Sept. 4. Put in one *L. chrysippus*. The Mantis showed its normal eagerness, and followed it about for some time, finally attempting to seize it, but failed. The vigorous flutterings of the butterfly seemed to frighten the Mantis, which ran away from it and made no further attempt to catch it.
„ 5. Put in two more *chrysippus*, but Mantis

was still scared and would not go near them.

Sept. 8. Mantis died. There were no signs of ill-health as in former experiments, and the characteristic blotch in the eye was absent. Death was probably due either to hunger or natural causes. I only wonder at its lasting so long, considering its long fast and unhealthy food.

[The above experiments upon Mantidæ of four different genera are summarized as follows:—

Mantis I., in the Karkloof. Evident intense dislike, after trial, of *Acræa horta*.

Mantis II., male, in the Karkloof. Evident dislike of *A. horta*, although one specimen out of three was almost entirely eaten. Two *A. cacheria* were eaten, and one partially. One *L. chrysippus*, one *B. severina*, and one *P. demodocus* were eaten.

Mantis III., female, probably *Polyspilota caffra*, at Malvern. Ate one *A. petræa*, but rejected *A. serena* after trial. Ate one male *H. misippus*, but after this refused all butterflies, and exhibited signs of weakness.

Mantis IV., female, probably the same species, at Malvern. Ate *Papilios* and *Nymphalinæ* freely, including the probably aposematic genus *Neptis*, and the probably aposematic Lycænid genera *Alæna* and *Pentila*, and Pierine genus *Mylothris*. Ate *L. chrysippus* with hesitation, and partially in one case, freely in two cases. Hence the Mantis appeared to be a very general feeder on all butterflies except the genus *Acræa*, the species of which (*cabira*, *serena*, *encedon*) were rarely eaten until after one or more trials, and were sometimes finally refused. *Natalica* was only offered once, and rejected after trial. It is interesting to note that immediately after trial of three different Acræas, the Mantis refused species which she freely ate at other times. The final weakness without power of recovery was a probable result of the diet.

Mantis V., male, *Pseudocreobotra wahlbergi*, on the Lower Umkomaas River. Ate *M. safitza*, *T. omphale*, and *Neptis agatha* freely, the first-named on three occasions. *Acræa cabira*, refused twice; *encedon*, refused twice after trial and accepted once; *serena*, refused on five occasions, eaten on four. It is probable that the weakness and loss of sight was due to the *Acræa* diet.

Mantis VI., *Phyllocrania insignis*, on the Lower Umkomaas River. The evidence that starvation for twelve and fourteen days respectively does not produce the symptoms observed in Experiments III., IV., V., VII., and IX.

Mantis VII., male, in pupal stage, probably *Polyspilota caffra*, at Malvern. The Pierines *T. achine* and *B. severina* freely eaten. Of the Acræas, two *encedon* eaten apparently freely, and one after an interval, others refused: one *serena* eaten after a time: of four *punctatissima* only one partly eaten. The Mantis then refused all food, became weak, and one eye was affected. He was unable to throw off the pupal skin properly. In Experiment VI. two individuals of another species performed this change of skin after ten and seven days of starvation.

Mantis VIII., female, *Pseudocreobotra wahlbergi*, at Malvern. Only offered Acræas. Nine *punctatissima* always refused with or without trial: *encedon* eaten freely several times, refused once, and partly eaten once; two *cabira* eaten freely; *serena* eaten freely or after trial; *neobule* eaten after two days' interval.

In spite of this diet the Mantis remained apparently healthy, September 26 to October 9, 1897, when the experiment came to an end.

Mantis IX., female, *Sphodromantis lineola*, at Salisbury. It was intended to offer this individual a purely *Acræa* diet, but she ate her mate on the third day after their capture *in copulâ*. She was chiefly fed upon *Acræa caldarena*, which she ate sometimes freely, sometimes after an interval and after trials: at other times she refused it with or without trial; one *induna* was eaten after a day's interval; one *neobule* was untouched; one *natalica* was partly eaten; two *hulali* were rejected after trial, one without. After a fortnight of this diet the Mantis became weak, and her left eye was affected: a day later she began to nibble off the end of one of her fore tarsi: two days later she oviposited, but the egg cocoon was only half its usual size (eggs infertile). After the first signs of weakness the Mantis ate only a small part of three Acræas out of eight offered her during six days. She continued to nibble at her tarsi, lost power over her movements, and died after twenty days of captivity.

Mantis X., female, *Sphodromantis lineola*, Salisbury. This individual was the subject of a control experiment, being fed solely upon several species of the following groups

—*Nymphalinæ, Pierinæ, Lycænidæ,* and *Hesperidæ.* The only species with marked aposematic colouring and habits was the Lycænid *Alæna amazoula,* and of this only two specimens were offered, both being eaten freely. After fifteen days of this diet the Mantis escaped: she was then as healthy and vigorous as when first captured.

Mantis XI., female, species resembling *Sphodromantis lineola,* Salisbury. Fed solely upon *Acræa caldarena* and *A. axina,* and *Limnas chrysippus,* with long periods of starvation, two of them a month in duration. Seventeen *chrysippus,* six *caldarena,* and three *axina* were eaten without any signs of distaste, while four *axina* were discarded after tasting several times. The Mantis was captured on April 3, 1898, and refused food on September 4, dying on September 8 without signs of ill-health or blindness. Mr. Marshall suggests that the species may be a winter form (possibly of *S. lineola*) specially adapted to eat Acræas when other butterflies are scarce.—E. B. P.]

3. Conclusions from Experiments on Mantidæ. (E. B. P.)

Certain conclusions stand out very clearly, while others are suggested as probable. These voracious insects did not show any dislike of butterflies outside the *Danainæ* and *Acræinæ.* The undoubtedly aposematic Pierine genus *Mylothris* was freely eaten, and so were the following genera with probable warning colours, movements, and attitudes—*Neptis, Alæna, Pentila,* and the moth *Egybolis vaillantina.* Even the *Danainæ* were generally eaten without hesitation (II., IV., XI.), and never rejected altogether. In marked contrast was the behaviour of *Mantidæ* towards *Acræinæ,* which were constantly refused, and often eaten only after one or more trials and long intervals of time. When the Acræas were eaten freely and without hesitation there is reason for suspecting exceptional hunger. The summary of experiments shows very clearly that "*Pardopsis* appears to be considerably more distasteful. . . . than the general run of Acræas" (G. A. K. M., October 7, 1897, Malvern). There were also less marked differences in the degree of dislike shown towards other species; thus *axina* was less freely eaten than *caldarena* (XI.); *caldarena* appeared to be eaten more freely than *halali, neobule, induna,* and *natalica*